ZINC

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In 2004, domestic zinc mine production, expressed in zinc content of ore, decreased by almost 4% compared with that of 2003, according to the U.S. Geological Survey (USGS). Based on recoverable content of concentrate and annual average U.S. price, the value of zinc mine production was estimated to be about $827 million, 25% greater than that of 2003. By yearend 2004, only seven mines in four States were operating in the United States. Mine closures in the past 3 years solidified Alaska's position as the leading producer of zinc concentrate, followed by Missouri, Washington, and Montana. In 2004, as in every year since the opening of Alaska's Red Dog Mine in 1989, U.S. mine production greatly exceeded smelter capacity. Concentrates were exported and refined zinc metal imported (tables 1, 6). Most of the zinc concentrate (70%) was exported to four countries—the Republic of Korea, followed by Canada, Japan, and Belgium, in descending order (table 14). Zinc metal production in the United States, which was provided by 2 primary smelters and 12 large- and medium-size secondary smelters, increased by about 1% in 2004 (table 4). More than one-half of zinc metal imports (zinc greater than or equal to 99.99% zinc) were from Canada, followed by Mexico and Namibia.

Apparent domestic consumption of refined zinc metal decreased to about 1.2 million metric tons (Mt). About one-half of metal consumed in the United States was used for galvanizing, followed by use in zinc-base alloys and brass and bronze (table 11). The agriculture, chemical, paint, and rubber industries were the primary users of zinc compounds and dust.

The average U.S. producer price for Special High Grade zinc in 2004, which was based on the London Metal Exchange (LME) daily cash price plus premium, increased by about 29% to $1.16 per kilogram (52.47 cents per pound) (table 1).

Legislation and Government Programs

A stockpile of zinc for national defense purposes has been maintained for more than 60 years. In 1992, Public Law 102-484 was signed, which authorized the disposal of the entire inventory of zinc from the National Defense Stockpile (NDS). The basic ordering agreement (BOA) under which zinc is currently sold from the NDS was established in May 2002. In April 2004, the BOA was amended to establish a minimum quote for an award of 20 metric tons (t) unless a smaller quantity was all that was available. Additionally, the Government changed its right to vary the quantity or weight delivered from that in the original bid to 5% from 2% on deliveries with a contract price adjustment to be made on the actual delivered zinc.

The Defense Logistics Agency (DLA), which maintains the NDS, was authorized to sell 45,400 t in fiscal year 2004 (October 1, 2003, to September 30, 2004). The DLA actually sold 38,200 t, with 52% under standard BOA agreements and the rest under long-term amendment. Because of an increase in market demand, BOA sales offerings were increased for March. The stockpile inventory on December 31, 2003, was 95,700 t, while the inventory at yearend 2004 was 61,700 t, all of which was authorized for disposal (U.S. Department of Defense, 2005, p. 10-11).

Environmental Issues

In April, The Red Dog Mine in Alaska was certified ISO 14001 Environmental Management System (EMS) compliant. Teck Cominco Limited (Canada), the mine owner and operator, took more than 2 years and 25,000 man-hours to establish the EMS and to have it certified (Teck Cominco Limited, 2004§[1]).

A process to recover zinc from electric arc furnace dust was developed and tested by the British firm ZincOx Resources plc. An economic assessment for a new zinc recycling plant using this process was prepared. More information on the process is discussed in the section on Current Research and Technology.

Production

Mine.—Efforts continued during 2004 to bring the Balmat Zinc Mine in upstate New York back into production. ONTZINC Corporation (Toronto, Ontario, Canada) signed a $10 million debt financing deal that would help allow them to restart operations at Balmat. The mine, formerly operated by Zinc Corporation of America, closed in May 2001 owing to low zinc prices. Inferred reserves amounted to 2 Mt grading 11.9% zinc, enough for a 10-year mine life. ONTZINC planned to focus on mining the higher grade ore in order to reduce operating cost (ONTZINC Corporation, 2003§).

ONTZINC later announced that it would commence operations at the Balmat Mine in December 2004. On August 24, the company secured a private investment of up to $5 million and was negotiating an additional line of credit. Production at Balmat was expected to reach 55,000 metric tons per year (t/yr), most of which would be shipped to Noranda Inc.'s Canadian Electrolytic Zinc Ltd. (CEZinc) refinery in Valleyfield, Quebec, Canada (CRU Monitor, 2004e).

[1]References that include a section mark (§) are found in the Internet References Cited section.

Shipments of zinc concentrates from Teck Cominco's Red Dog Mine are affected by local inhabitants who engage in subsistence hunting near the port until early summer and by an early freeze, which closes shipping in mid-October. A large part of the 554,000 t of zinc in concentrate produced was shipped to the company's Trail, British Columbia, Canada, facility with the remaining production shipped to a variety of consumers mainly in Asia and Europe (American Metal Market, 2004).

Mine production from the Red Dog Mine in 2004 was about 4% lower compared with that of 2003 owing to processing problems related to excessive process pipe scaling during the first quarter. Teck's Pend Oreille Mine in northeastern Washington State began commercial production in August and by yearend had produced 17,000 t of zinc in concentrates. Pend Oreille's proven and probable reserves at yearend were 5.3 Mt at 7.5% zinc and 1.2% lead with significant germanium associated with the zinc ore. An additional 3.3 Mt of ore containing 6.6% zinc and 1.3% lead was inferred. Design capacity of 50,000 t/yr of zinc in concentrate and 8,000 t/yr of lead in concentrate was expected to be reached in 2005 (Teck Cominco Limited, 2005, p. 17, 28, 29, 74, 75).

In September, CalEnergy Minerals LLC (a subsidiary of MidAmerican Energy Holdings Company), headquartered in the Imperial Valley, 145 kilometers south of Palm Springs, CA, ceased zinc recovery operations at its Salton Sea plant in southern California and sought a buyer for the plant in order to finance termination benefits for employees. Zinc production lagged well below the original plan of 30,000 t/yr, and despite recent increases in refined zinc prices, the company ran up large losses since it began operations in December 2002 (CRU International Ltd., 2004d).

Smelter.—A strike at Big River Zinc's Sauget, IL, refinery was averted when a majority of the 220 unionized workers agreed to a 1-year extension to the existing labor agreement, which had been due to expire in May. Big River Zinc (a subsidiary of Korea Zinc Co. Ltd.) produces about 90,000 t/yr of zinc as refined zinc metal, zinc alloys, zinc powders, zinc sulfate, and zinc oxide. The company also produces electrolytic or commercial grade sulfuric acid and high-purity cadmium oxide (Metal-Pages, 2004a§).

Prices

The zinc price at yearend on the LME reached a 7-year high of $1,255.50 per metric ton, an increase of more than 20% from that at the start of the year. During the year, LME stocks declined by about 17% to 634,000 t. China reportedly was the major reason for the price increase as consumption has risen to about one-fifth of the world's zinc. China's demand had been forecast to grow between 11% and 18% in 2005. Because of increased demand in China, world consumption in 2005 was expected to be about 280,000 t greater than production (Metal-Pages, 2004d§).

World Review

Australia.—In early April, Zinifex Limited (Australia) was formed from key Pasminco Limited assets and listed on the Australian Stock Exchange. Zinifex expected to earn 57% of its sales revenue from zinc metal and planned to increase output of value-added zinc products (CRU Monitor, 2004c). Zinifex's main zinc assets were three mines and four smelters. In 2004, the full-year production of zinc in concentrate for Zinifex's mining properties were as follows: 1) the Century open pit zinc-lead mine in northwest Queensland, the world's second ranked zinc mine after Teck Cominco's Red Dog Mine, 517,000 t; 2) the Rosebery Mine in western Tasmania, 92,000 t; and 3) the Clinch Valley Mine in Tennessee in the United States, 2,000 t before it was closed down and sold by Pasminco to Mossy Creek LLC in March. At the Century Mine, more exploration leases were applied for and drilling on these new leases began.

In 2004, the full-year zinc production for Zinifex's smelters were as follows: 1) Hobart in Tasmania, 248,000 t; 2) Port Pirie in South Australia, which is mainly a lead smelter, 37,000 t; 3) Budel, in the Netherlands, 224,000 t; and 4) Clarksville, in the United States, 114,000 t. The Hobart smelter production was impacted by smelter issues in the fourth quarter and sales were lower owing to rail problems. The Port Pirie smelter zinc production was affected by slag fumer issues (Pasminco Limited, 2004; Zinifex Limited, 2004a, b, 2005).

In June, Xstrata plc of Switzerland approved the development of the Black Star lead and zinc open pit mine at Mount Isa in northwest Queensland, Australia. The mine, originally expected to supply 1.5 million metric tons per year (Mt/yr) of ore, had planned production increased to 2.3 Mt/yr (Xstrata plc, 2005, p. 63). The ore from Black Star was to supplement current output from the George Fisher and Mount Isa underground mines, also in Queensland. Development started as soon as the required Queensland State government approvals were received, and prestripping began in the second half of 2004. Start of commercial production was scheduled for the first quarter of 2005 (CRU International Ltd., 2004c). The drilling in the Black Star Mine area, upon which the original development decision had been based, had defined a mineral resource of 24.2 Mt grading 5.1% zinc, 2.7% lead, and 54 grams per metric ton (g/t) silver. The stripping ratio associated with mining these initial reserves was approximately 4:1, with a planned pit depth of 200 meters (m) (Xstrata plc, 2004§).

Canada.—Zinc mine production in Canada has declined in recent years following numerous mine closures, although not all closures affect the country's total refined zinc production. For example, the Polaris and Nanisvik Mines, located in Northwest Territories (owned by Teck Cominco and Breakwater Resources Ltd., respectively) did not supply Canadian smelters, but instead the entire production was shipped to Europe. Before it closed in December 2001, Teck Cominco's Sullivan Mine shipped all of its 100,000-t/yr zinc concentrate production to the Trail smelter in British Columbia. Closure of BHP Billiton Ltd.'s Selbai Mine (Quebec) in 2004 deprived Kidd Creek smelter in Ontario of about 30,000 t/yr of zinc concentrate, which had to be replaced by concentrate from Agnico-Eagle Mines Limited. An additional three mines in Quebec closed by yearend 2005—the Bell Allard Mine by the end of 2004 and the Louvicourt and Bouchard-Hebért Mines during 2005. These closures left Quebec with just LaRonde as a sole producer of zinc concentrate. Because of the decline in local mine production, Valleyfield (CEZ) smelter in Quebec had to increase its imports of zinc concentrate. However, mine production could improve significantly if Breakwater reopens its Langlois

Mine (Quebec) and Noranda Ltd. reopens the Matagami mill (Quebec) and develops the Perseverance deposit (Quebec). These two mines and mill in Quebec could add about 125,000 t/yr of zinc in concentrate to Canadian production (CRU Monitor, 2004b).

Falconbridge Ltd. signed a life-of-mine agreement to process 60% to 75%, up to maximum of 125,000 t/yr, of the precious-metal-bearing zinc and copper concentrates produced by Agnico-Eagle Mines Ltd. from its LaRonde Mine in Quebec. The agreement improved the overall operating economics of both companies. Falconbridge benefited from better capacity utilization at its Kidd Creek operations, while Agnico-Eagle saved on transportation costs and recovered more precious metal (Platts Metals Week, 2004b).

In June, Virginia Gold Mines Inc. and Noranda signed an agreement on the Coulon project, located near Fontanges Airport in the James Bay area of Quebec. The agreement stipulated that Noranda would invest a minimum of $1 million per year, and Virginia Gold Mines would be the operator of the project up to the completion of a prefeasibility study. Noranda would have the option to acquire 50% interest in the project. Recent exploration returned values of 9.94% zinc, 2.12% lead, 0.73% copper, and 96.4 g/t silver over 19.5 m in the Dom zone. Additional drilling in the Dom Nord zone of this project indicated values of 0.59% zinc, 1.31% copper, 12.6 g/t silver over an interval of 38.1 m (Virginia Gold Mines Inc., 2004a§, b§).

In July, Breakwater Resources of Canada announced the acquisition of Boliden Westmin Ltd. (a subsidiary of Boliden AB), owner and operator of Myra Falls zinc-copper mine in the southern part of British Columbia. In 2003, Myra Falls produced 57,400 t of contained zinc and 10,700 t of copper in concentrate (Platts Metals Week, 2004a). Breakwater expected the acquisition to increase its net revenue during the next 6 years by about 85%. Although the mine is predominantly a zinc producer and will increase Breakwater's zinc output by about 68%, Myra Falls will actually lessen the company's reliance on zinc owing to the significant value of byproduct copper, gold, and silver production. Myra Falls had proven and probable reserves of 7.8 Mt grading 6.3% zinc, 1.2% copper, 1.2 g/t gold, and 40 g/t silver. The acquisition increased the company's contained zinc reserves and resources by about 41% (Mining Journal, 2004a).

Falconbridge hoisted the first ore from the new shaft of Mine D at its Kidd Creek operations in Ontario. Full production was projected for 2006, ensuring that Kidd Creek will continue to operate at a capacity of 2.4 Mt/yr of ore. The new mine will boost production that fell behind by 35% in the second quarter of 2004 compared with that of the same period in 2003. The reason for the decrease was failed ventilation fans, ground stability problems, maintenance issues, stope blockage, and, most importantly, a change in the mining plan to take advantage of high-grade copper ore (CRU Monitor, 2004f).

In December, ONTZINC bought the Hudson Bay Mining and Smelting Co. Ltd. (Manitoba) from Anglo American International S.A. (a subsidiary of Anglo American plc) for Can$143.8 million in equity and US$175 million in debt offerings. ONTZINC then changed its name to HudBay Minerals Inc. At the yearend 2004 production rate, Hudson Bay's ore reserves could last for 13 years, with an excellent potential for further discoveries on 280,000 hectares of land owned by the company in Manitoba and Saskatchewan. Hudson Bay operated a recently expanded 100,000-t/yr zinc refinery at Flin Flon, Manitoba, where a new cell house was installed and infrastructure was upgraded. In addition, two new mining projects were developed (Platts Metals Week, 2004d). In 2003, Hudson Bay's production was estimated to have been 101,000 t of zinc in concentrate and 117,900 t of refined zinc metal (CRU Monitor, 2004a; HudBay Minerals Inc., 2004§).

In October, mining ceased at the Bell Allard Mine, owned by Noranda, owing to depletion of ore reserves. Total output for the year was 97,800 t of contained zinc. Ore from the mine was processed at the Matagami mill, which was put on care and maintenance until Noranda begins mining the Perseverance deposit (CRU Monitor, 2004g).

China.—During the first 4 months of 2004, 24 provinces in China were forced to impose restrictions on electricity consumption. The energy shortage had its greatest effect in the eastern part of the country, where most of China's heavy industry is located. The shortage was not caused by an inadequate supply, but rather by inefficient energy use, a problem that will not be easy to rectify (Antaike, 2004b).

Power shortages in southern China forced many zinc smelters to reduce output in 2004. In January, the Liuzhou Longcheng Chemical Industry Plant cut zinc production to one-third of capacity owing to electric power shortages in the Guangxi region. Liuzhou was the fifth ranked zinc producer in China in 2003 (CRU International Ltd., 2004b). The Longcheng smelter operated at an average rate of 65% of capacity in 2004, and Zhuye Torch Metals Co. Ltd. (known as Zhuzhou) in Hunan, China's second ranked zinc producer, lowered production rates by about 30%. Smelters in northern China, where power supplies were more stable, had to contend with a tight concentrate market, rising power costs, and limited water and fuel supplies. Production at the Huludao Zinc Industry Co. in Liaoning Province amounted to only about 230,000 t of zinc in 2004 despite a capacity of 330,000 t/yr of zinc. These power shortages came at an inopportune time for China. China's zinc consumption had grown an estimated 13% in 2003, driven by a 33% increase in investment in construction and an 81% increase in car production (CRU International Ltd., 2004a; Metal-Pages, 2005b§).

China and Pakistan signed an agreement to develop the Duddar lead and zinc deposit near Karachi in the province of Balochistan, Pakistan. It will take 2½ years and an investment of about $70 million to develop the mine that was planned to produce about 100,000 t/yr of zinc concentrate and 32,600 t/yr of lead concentrate (China Mining and Mineral Commodity Market, 2004).

Henan Yuguang Gold and Lead Group, the leading lead producer in China, had expected to complete its 100,000-t/yr zinc plant in November 2004 (the plant reportedly began production in early May 2005). Most of the feed was to be supplied by its recently purchased mines in Sichuan and Inner Mongolia (Metal-Pages, 2005c§).

As a result of struggling with diminishing sources of domestic concentrates and numerous Chinese smelting companies expanding their capacities or building new plants, China imported increasing amounts of concentrates, metal, and galvanized steel (nearly one-half of zinc is used for galvanizing). The country had become a net importer of about 350,000 t of zinc in concentrate in 2001, having been a net exporter in 2000 (Antaike, 2004a). The scarcity of concentrates, however, did not deter Qinling Non-Ferrous Metals Corp. from increasing its production capacity by nearly 150%. A 100,000-t/yr addition to its 70,000-t/yr smelter was expected to be completed by 2005 (Metal-Pages, 2004c§).

India.—Hindustan Zinc Ltd. (HZL) planned to increase the capacity of its smelters by 73% to 400,000 t/yr by 2005. Increased feed requirements were to be supplied by an expansion at the Rampura Agucha Mine. In addition, HZL planned to build a 154-megawatt coal-fired powerplant. This expansion was in response to domestic demand for refined zinc that is growing at the rate of 12% to 15% per year (Metal Bulletin, 2004a).

Iran.—Union Capital Ltd. (Australia) commenced studies into the feasibility of staged development of the Mehdiabad zinc, silver, and lead deposit in central Iran. The deposit is the leading zinc oxide deposit in the world, containing about one-fourth of the world's known zinc oxide resources. The first stage of development of the deposit, which is amenable to processing by acid leaching, is expected to be online by 2006 and would include a trial mine, pilot plant, and the development of a demonstration plant producing about 30,000 t/yr of zinc metal. Cash flow from this project was expected to finance the next three stages of development.

Mehdiabad, when fully developed, could produce up to 500,000 t/yr of zinc for 30 years, making it one of the leading mines in the world. Current activity was focusing on the metallurgical test work and development of the plant flow sheet. The most critical aspect of the flow sheet was the purification circuit, where all the impurities leached into solution with the zinc must be removed prior to electrowinning. The deposit [jointly owned by Union Capital, an Iranian Government company (IMPASCO), and Itok GmbH] contains 218 Mt of resources grading 7.2% zinc, 2.3% lead, and 51 g/t silver (Union Capital Limited, 2004§).

Ireland.—Tara Mines Ltd. of Ireland declared force majeure on shipments of zinc concentrate until a work stoppage involving underground miners was resolved. The mine, the leading zinc mine in Europe, produces about 200,000 t/yr of zinc in concentrate. Management at the zinc mine, owned by Boliden AB of Sweden, agreed to meet union representatives on June 3 after laying off some 240 workers, who had been on strike since June 1 (Metal Bulletin, 2004b).

Italy.—The Porto Vesme complex in Sardinia returned to production. Although it had been closed since October 2003, owing to high electricity costs, zinc and lead concentrate continued to be delivered to the smelter owned by Glencore International AG (Switzerland). The complex consists of an 85,000-t/yr Imperial smelting furnace, an electrolytic zinc smelter with a capacity of 103,000 t/yr, and a 100,000-t/yr lead smelter (Platts Metals Week, 2004f).

Following the reopening of the electrolytic zinc smelter and Kivcet lead smelter on April 1, operation of the imperial smelting furnace at the Porto Vesme metallurgical complex was restarted on July 5. Operations at Porto Vesme were idled after Glencore failed to secure lower energy prices from the Italian Government. Reopening of Porto Vesme was made possible by higher zinc prices that allowed profitable operation at the complex despite unchanged electricity rates, which were the highest in Europe (CRU Monitor, 2004h). Subsequently, the Italian Government agreed to maintain a special electricity rate for the Porto Vesme zinc and lead smelter, granted at the beginning of 2004, despite objections by the European Commission (Platts Metals Week, 2004c).

While high-electricity prices plagued the Porto Vesme electrolytic zinc refinery, high-coke prices were the problem for the Porto Vesme imperial smelting furnace. The price of coke, imported mainly from China, doubled in 2004 compared with the price in 2003. The high-energy prices, coupled with failure of the unions and the management to reach an agreement, still threaten the viability of the Porto Vesme complex. If the complex closes, the zinc concentrate was expected to be quickly absorbed by other smelters, but the bulk lead-zinc concentrate from the McArthur River Mine in Australia would be much harder to sell because the number of smelters using the imperial smelting process has been reduced. The Porto Vesme complex was a leading employer in the economically depressed region of southwest Sardinia, and the unions were expected to fight any closure or job losses (CRU Monitor, 2005§).

Japan.—Nippon Mining Holdings Inc. announced that it would close the Toyoha Mine (Hokkaido, northern Japan), the last remaining zinc mine in Japan, in March 2006. The reason for closure is the depletion of resources and failure of a nearly year-long exploratory drilling program to find new resources (Metal-Pages, 2005a§).

Kazakhstan.—A new 100,000-t/yr smelter was on target to reach nameplate capacity in 2005, having made its first deliveries. The Balkhash smelter in southeastern Kazakhstan, inaugurated in October 2003, was built for $150 million and already had supplied 250 t of zinc to domestic customers by the end of April (Metal-Pages, 2004b§).

Peru.—In February, The Doe Run Company, St. Louis, MO, was reported to have planned to close part of the zinc smelting capacity at its Oroya complex in Peru in 2005 in order to reduce emissions, which Doe Run agreed to when it purchased the complex from the Peruvian Government in 1997. The closure of the oldest section of the zinc operation would reduce production by about 40% to 45,000 t/yr. Closure could be avoided if the Peruvian Government agreed to extend the deadline until the end of 2011. If the Government approved the extension, Doe Run would be willing to spend $150 million on environmental improvements that would reduce "fugitive" emissions, which are eight times higher than those from the stacks (Mining Journal, 2004c). In April, the Peruvian Government denied Doe Run's request for extension to reduce arsenic, lead, and sulfur dioxide emissions past the original December 2006 deadline. After investing $120 million, Doe Run had met only 23% of its obligations (Mining Journal, 2004d).

In late November, workers at the La Oroya smelter joined local townspeople and farmers in an effort to compel the Peruvian Government to accept Doe Run's request. When Doe Run bought the smelter, it agreed to build an acid plant by yearend 2006 to capture sulfur dioxide emissions in accordance with PAMA, the program to administer and maintain the environment. Doe Run insisted that it first must address the previously overlooked and more pressing issue of nonstack emissions of lead before the acid plant was built. La Oroya produced 700 metric tons per day of metals, including copper, lead, zinc, and eight other metals; nine nonmetal byproducts; and three alloys (Platts Metals Week, 2004e). Compliance with the PAMA was a requirement for loans covering the financing and development of the plant, and failure to comply or gain an extension would put Doe Run in default (CRU Monitor, 2004i).

At yearend, the Peruvian Government issued a decree that enabled Doe Run to seek an extension on its PAMA. Doe Run was allowed to continue operations and related economic investments in order to further the ongoing efforts to address the health and environmental issues at La Oroya (Doe Run Company, The, 2004§).

Pan American Silver Ltd. of Canada bought an 88% equity interest in the Morococha mining complex in Peru from Sociedad Minera Corona S.A. Morococha assets included the Anticona and Manuelita Mines, with proven and probable reserves totaling 1.06 Mt grading 4.94% zinc and 269 g/t silver (CRU Monitor, 2004d).

In mid-November, Teck Cominco and Marubeni Corp. of Japan announced the decision to sell their respective interests in the Cajamarquilla zinc refinery in Peru. Cia. Mineira de Metais (a subsidiary of Grupo Votorantim) of Brazil agreed to pay $210 million, of which 85% would be paid to Teck and 15% to Marubeni. Teck and Marubeni acquired their interests in Cajamarquilla in 1995 when the refinery was privatized by the Peruvian Government and they subsequently expanded the operation to 130,000 t/yr. The sale was finalized in mid-December. Most of the zinc concentrate for the refinery came from Peruvian mines, including Antamina, in which Teck Cominco holds a 22.5% interest (Mining Journal, 2004b).

Sweden.—Rio Tinto Limited sold its subsidiary Zinkgruvan Mining AB of Sweden to South Atlantic Ventures Limited of British Columbia, Canada (currently Lundin Mining Corporation), for $101 million, $5.3 million in working capital, and a maximum $5 million price-based bonus to be paid during the next 2 years. In 2003, Zinkgruvan produced 66,000 t of zinc, 32,000 t of lead, and 55 t of silver (South Atlantic Ventures Limited, 2004§).

Current Research and Technology

ZincOx Resources completed an economic assessment for a new zinc recycling plant in the United States. The company entered into a strategic alliance with Envirosafe Services of Ohio, Inc. (ESOI) to recover zinc from electric arc furnace (EAF) dust. EAF dust is either deposited in special landfills, at great cost to the steel mills, or processed in Waelz kilns to produce zinc concentrate and other metals. The process is not cost effective and relies heavily on subsidies. Worldwide, there are about 3.0 Mt of EAF dust containing about 0.7 Mt of zinc (7% of annual global consumption). The plant, using technology developed by ZincOx, was expected to be located in the midwestern United States and to produce 20,000 t/yr of zinc oxide. A feasibility study began in January 2005 (ZincOx Resources plc, 2005, p. 6, 10).

Outlook

According to the International Lead and Zinc Study Group (2005§), world demand for refined zinc metal is expected to rise by about 2.4% to 10.7 Mt in 2005. Mine output is expected to be 5.2% higher than that of 2004 with the only reduction being in the world's leading producer—Canada (14%). In spite of production cutbacks at Umicore, SA's operation in France, world refined zinc metal output was expected to rise to about 10.5 Mt in 2005. Expansions in China, India, Japan, Kazakhstan, and the Republic of Korea were expected to fuel this 3.3% rise. Overall a deficit of 200,000 t of refined zinc is expected in 2005. This imbalance could result in continued zinc price increases.

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TABLE 1
SALIENT ZINC STATISTICS[1]

		2000	2001	2002	2003	2004
United States:						
Production:						
Domestic ores, contained zinc	metric tons	852,000	842,000	780,000	768,000	739,000
Domestic ores, recoverable zinc	do.	805,000	799,000	701,000 r	738,000 r	715,000
Value, recoverable zinc	thousands	$987,000	$774,000	$664,000	$661,000	$827,000 e
Refined zinc:						
From domestic ores	metric tons	137,000	169,000	151,000	155,000	156,000
From foreign ores	do.	90,800	34,000	30,800	31,900	32,200
From scrap	do.	143,000	108,000	113,000	116,000	117,000
Total	do.	371,000	311,000	294,000	303,000	305,000
Secondary zinc[2]	do.	297,000	267,000	253,000	265,000	241,000
Exports:						
Ores and concentrates, zinc content	do.	523,000	696,000	822,000	841,000	745,000
Slab zinc	do.	2,770	1,180	1,160	1,680	3,300
Rolled zinc	do.	3,530	5,700	7,200	9,430	9,770
Imports for consumption:						
Ores and concentrates, zinc content	do.	52,800	84,000	122,000	164,000	231,000
Refined (slab) zinc	do.	915,000	813,000	874,000	758,000	812,000
Rolled zinc	do.	9,380	7,240	1,640	1,790	2,500
Stocks of slab zinc, December 31:						
Producer	do.	7,890	7,380	8,550	7,660	6,430
Consumer	do.	58,300	57,100	59,100	55,300	56,300
Merchant	do.	10,500	10,300	9,970	10,300	10,200
Total	do.	76,600	74,700	77,600	73,300	73,000
Government stockpile	do.	138,000	120,000	109,000	95,200	66,400
Consumption, refined zinc:						
Reported	do.	634,000	543,000	496,000	506,000	510,000
Apparent[3]	do.	1,330,000	1,150,000	1,170,000	1,080,000	1,160,000
All classes[4]	do.	1,630,000	1,420,000	1,420,000	1,340,000	1,400,000
Price, special high grade	cents per pound	55.61	43.96	38.64	40.63	52.47
World:						
Production:						
Mine	thousand metric tons	8,770	8,910 r	8,520 r	9,600 r	9,600
Smelter	do.	9,030 r	9,270 r	9,690 r	9,860 r	10,000
Price, London Metal Exchange	cents per pound	51.15	40.16	35.31	37.53	47.51

eEstimated. rRevised.

[1]Data are rounded to no more than three significant digits, except prices; may not add to totals shown.

[2]Zinc in metal products and compounds derived directly from scrap; refined secondary zinc is listed separately in the table.

[3]Domestic production plus net imports, plus or minus stock changes.

[4]Apparent consumption of refined zinc plus reported consumption of zinc in metal products and compounds derived directly from ore, concentrate, or scrap.

TABLE 2
MINE PRODUCTION OF RECOVERABLE ZINC
IN THE UNITED STATES, BY STATE[1]

(Metric tons)

State	2003	2004
Alaska[2]	656,000	630,000
Missouri	39,100	40,400
Montana	15,200	14,800
Other[3]	27,800 r	29,400
Total	738,000 r	715,000

rRevised.
[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Data based, in part, on publicly available information.
[3]Includes production from Idaho, Tennessee, and Washington.

TABLE 3

LEADING ZINC-PRODUCING MINES IN THE UNITED STATES IN 2004, IN ORDER OF OUTPUT

Rank	Mine	County and State	Operator	Source of zinc
1	Red Dog	Northwest Arctic, AK	Teck Cominco Alaska Inc.	Lead-zinc ore.
2	Greens Creek	Juneau, AK	Kennecott Greens Creek Mining Co.	Zinc ore.
3	Pend Oreille	Pend Oreille, WA	Teck Cominco American Inc.	Do.
4	Brushy Creek	Reynolds, MO	Doe Run Resources Corp.	Lead ore.
5	Montana Tunnels	Jefferson, MT	Apollo Gold Corp.	Gold ore.
6	Fletcher	Reynolds, MO	Doe Run Resources Corp.	Lead ore.
7	Buick	Iron, MO	do.	Do.

TABLE 4
REFINED ZINC PRODUCED IN THE UNITED STATES[1]

(Metric tons)

	2003	2004
Primary:		
From domestic ores	155,000	156,000
From foreign ores	31,900	32,200
Total	187,000	189,000
Secondary	116,000	117,000
Grand total[2]	303,000	305,000

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Excludes zinc recovered by remelting.

TABLE 5
REFINED ZINC PRODUCED IN THE UNITED STATES, BY GRADE[1]

(Metric tons)

Grade	2003	2004
Special high	97,100	94,600
Continuous galvanizing	110,000	108,000
Other[2]	95,100	102,000
Total	303,000	305,000

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Includes controlled lead, high, and prime western grades.

TABLE 6
SLAB ZINC CAPACITY OF PRIMARY ZINC PLANTS IN THE UNITED STATES,
BY TYPE OF PLANT AND COMPANY

(Metric tons)

Type of plant and company	2003	2004
Electrolytic:		
Big River Zinc Corp., Sauget, IL	100,000	100,000
Pasminco Ltd., Clarksville, TN	115,000	115,000
Electrothermic, Zinc Corporation of America, Monaca, PA	--	--
Total	215,000 r	215,000

rRevised. -- Zero.

TABLE 7
STOCKS AND CONSUMPTION OF NEW AND OLD ZINC SCRAP IN THE UNITED STATES IN 2004, BY TYPE OF SCRAP[1]

(Metric tons, zinc content)

Type of scrap	Stocks, January 1	Consumption				Stocks, December 31
		Receipts	New scrap	Old scrap	Total	
Diecastings	W	W	--	W	W	116
Flue dust	341	69,000	34,500	34,500	69,000	341
Galvanizer's dross	2,830	41,000	41,000	--	41,000	2,830
Old zinc[2]	70	372	--	340	340	102
Remelt die-cast slab	W	W	--	W	W	83
Remelt zinc[3]	1,240	47,300	47,300	--	47,300	1,240
Skimmings and ashes[4]	W	22,300	22,400	--	22,400	420
Other[5]	913	17,500	10,900	6,720	17,600	63
Total	5,390 [r]	197,000	156,000	41,600	198,000	5,190

[r]Revised. W Withheld to avoid disclosing company proprietary data; included with "Other." -- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Includes engraver's plates and rod and die scrap.

[3]Includes new clippings.

[4]Includes slab and die-cast skimmings.

[5]Includes chemical residues and solutions, electrogalvanizing anodes, fragmentized diecastings, and steelmaking dust.

TABLE 8
PRODUCTION OF ZINC PRODUCTS FROM
ZINC-BASE SCRAP IN THE UNITED STATES[1]

(Metric tons)

Products	2003	2004
Redistilled slab zinc	116,000	117,000
Other zinc metal products[2]	8,210	6,930
Zinc in chemical products	44,000	27,500
Zinc dust	4,070	5,020

[1]Data are rounded to no more than three significant digits.
[2]Includes electrogalvanizing anodes, remelt die-cast slab, and other metal alloys.

TABLE 9
ZINC RECOVERED FROM SCRAP PROCESSED IN THE UNITED STATES, BY TYPE OF SCRAP AND FORM OF RECOVERY[1]

(Metric tons)

	2003	2004
Type of scrap:		
New scrap:		
Zinc-base	149,000	151,000
Copper-base	146,000	151,000
Magnesium-base	548	548 [e]
Total	295,000	302,000
Old scrap:		
Zinc-base	40,900	39,900
Copper-base	9,340	6,290
Aluminum-base	548	548 [e]
Magnesium-base	338	338 [e]
Total	50,300	47,100
Grand total	345,000	349,000
Form of recovery:		
Metal:		
Slab zinc	116,000	117,000
Zinc dust	4,070	6,970
Total	120,000	124,000
In brass and bronze	176,000	168,000
In chemical products:		
Zinc oxide (lead free)	14,900	15,600
Zinc sulfate	24,000	22,900
Miscellaneous[2]	9,950	9,550
Total	225,000	217,000
Grand total	345,000	340,000

[e]Estimated.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Includes chlorine, electrogalvanizing anodes, and zinc content of slab made from remelt die-cast slab.

TABLE 10
U.S. CONSUMPTION OF ZINC[1]

(Metric tons)

	2003	2004
Refined zinc, apparent	1,080,000	1,160,000
Ores and concentrates, zinc content	654	617
Secondary, zinc content[2]	265,000	241,000
Total	1,340,000	1,400,000

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Excludes secondary slab zinc and remelt zinc.

TABLE 11

U.S. REPORTED CONSUMPTION OF ZINC IN 2004, BY INDUSTRY USE AND GRADE[1]

(Metric tons)

Industry use	Special high grade	High grade	Prime western	Remelt and other grades	Total
Galvanizing	111,000	35,300	67,600	33,600	248,000
Zinc-base alloys	W	W	W	W	W
Brass and bronze	45,700	W	W	W	96,700
Other	164,000	23,500	28,600	--	XX
Total	321,000	58,800	96,200	33,600	510,000

W Withheld to avoid disclosing company proprietary data. XX Not applicable. -- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

TABLE 12
ZINC CONTAINED IN PIGMENTS AND COMPOUNDS PRODUCED AND SHIPPED IN THE UNITED STATES[1, 2]

(Metric tons)

	2003		2004	
	Production	Shipments	Production	Shipments
Zinc oxide	31,700	31,700	29,500	28,400
Zinc sulfate	25,200	25,200	24,300	24,200

[1]Excludes leaded zinc oxide, lithopone, and zinc chloride.
[2]Data are rounded to no more than three significant digits.

TABLE 13
REPORTED SHIPMENTS OF ZINC CONTAINED
IN ZINC OXIDE, BY INDUSTRY[1, 2]

(Metric tons)

	2003	2004
Ceramics	420	383
Chemicals	5,670	5,000
Paints	1,950	1,820
Rubber	22,500	20,300
Other[3]	1,110	895
Total	31,700	28,400

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]In addition, zinc contained in zinc oxide was imported as follows: 2003—98,345 and 2004—103,089; distribution cannot be distinguished by industry.

[3]Includes agriculture and photocopying.

TABLE 14

U.S. EXPORTS OF ZINC ORES AND CONCENTRATES, BY COUNTRY[1]

	2003		2004	
	Quantity (metric tons, zinc content)	Value (thousands)	Quantity (metric tons, zinc content)	Value (thousands)
Australia	24,400	$10,900	37,300	$21,600
Belgium	115,000	50,500	74,000	36,100
Brazil	129	90	287	167
Bulgaria	--	--	32,400	18,800
Canada	220,000	93,400	152,000	119,000
China	132	136	865	187
Finland	36,600	16,300	33,400	19,400
Gambia, The	--	--	12,200	7,080
Germany	54,900 r	24,500 r	20,300	11,800
Italy	42,400	11,000	8	17
Japan	128,000	36,800	111,000	40,000
Korea, Republic of	142,000	58,100	184,000	90,000
Netherlands	39,600	17,700	--	--
Spain	39,200	17,500	86,900	47,900
Other	23 r	37 r	217	378
Total	841,000	337,000	745,000	413,000

rRevised. -- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 15
U.S. EXPORTS OF ZINC COMPOUNDS[1]

	2003		2004	
	Quantity (metric tons, gross weight)	Value (thousands)	Quantity (metric tons, gross weight)	Value (thousands)
Zinc chloride	1,470	$1,650	1,870	$2,200
Zinc compounds, n.s.p.f.[2]	6,730	9,570	7,840	14,300
Zinc oxide	12,100	15,200	14,400	19,800
Zinc sulfate	2,310	1,440	3,060	1,860

[1]Data are rounded to no more than three significant digits.
[2]Not specifically provided for.

Source: U.S. Census Bureau.

TABLE 16

U.S. IMPORTS FOR CONSUMPTION OF ZINC COMPOUNDS[1]

	2003		2004	
	Quantity (metric tons, gross weight)	Value (thousands)	Quantity (metric tons, gross weight)	Value (thousands)
Lithopone	860	$644	3,950	$2,600
Zinc chloride	663	914	705	863
Zinc compounds, n.s.p.f.[2]	1	5	16	29
Zinc hydrosulfite	248	312	102	300
Zinc oxide	98,300	72,200	103,000	89,000
Zinc sulfate	25,800	11,700	29,100	14,000

[1]Data are rounded to no more than three significant digits.

[2]Not specifically provided for.

Source: U.S. Census Bureau.

TABLE 17

ZINC: WORLD MINE PRODUCTION, BY COUNTRY[1, 2]

(Metric tons, zinc content of concentrate and direct shipping ore, unless otherwise specified)

Country	2000	2001	2002	2003	2004[e]
Algeria	10,452	10,693	8,576	3,000 [r]	5,000
Argentina	34,858	39,703	37,325	30,000 [r]	26,000 [p]
Australia	1,420,000	1,519,000	1,154,000	1,480,000	1,334,000 [3]
Bolivia	149,134	145,306 [r]	141,558	144,985	145,000
Bosnia and Herzegovina[e]	300	300	300	300	300
Brazil	100,254	111,432	136,339 [r]	152,823 [r]	160,000
Bulgaria[e]	9,400	12,100	14,900 [r]	12,000 [r]	11,000
Burma	437	467	166 [r, 4]	152 [r]	200
Canada	1,002,242	1,012,048	923,931 [r]	788,063 [r]	790,757 [3]
Chile	31,403	32,762	36,161	33,051 [r]	27,000
China	1,780,000	1,700,000	1,550,000	2,030,000 [r]	2,260,000
Congo, (Kinshasa)	215	1,014	1,000 [e]	1,000 [e]	--
Ecuador[e]	100	100	100	100	100
Finland	30,493	36,253	34,100	38,900	37,200 [3]
Georgia[e]	200	200 [r]	400	400	400
Greece	16,900	31,700	33,000	3,000 [r]	--
Honduras	31,226	48,485	46,339	44,000 [r, e]	41,000
India[e]	144,000	146,000	234,000 [r]	305,000 [r]	341,000
Iran[e]	90,000	120,000	120,000	120,000	114,000
Ireland	262,877	225,135	252,700	419,000 [r]	438,000
Japan	63,601	44,519	42,851	44,574	47,781 [3]
Kazakhstan	325,000	344,300	390,000	395,000	360,000
Korea, North[e]	60,000 [r]	60,000 [r]	60,000 [r]	60,000 [r]	60,000
Korea, Republic of	11,474	5,129	99	-- [e]	--
Macedonia	12,200	6,300	2,100	-- [r]	--
Mexico	392,791	428,828	446,104	472,000 [r]	462,000
Morocco	103,064	89,339	91,000 [e]	70,000 [e]	70,000
Namibia	39,126	37,622	42,685	108,000 [r, 5]	198,000
Peru	910,303	1,056,629	1,221,830	1,372,790 [r]	1,209,006 [3]
Poland	156,900	152,700	152,200	152,300 [r]	153,000
Romania	27,455	29,786	21,200 [r]	23,464 [r]	24,000
Russia	136,000	124,000 [e]	130,000	159,000 [r, e]	179,000
Saudi Arabia[e]	3,000	3,300 [3]	3,000	3,000	1,500
Serbia and Montenegro	3,266 [r]	5,988 [r]	6,900 [r]	-- [r]	--
South Africa	62,703	61,221	64,173	41,239	32,001 [3]
Spain	201,000	164,900	69,900	15,000 [r]	--
Sweden	176,788	156,334	148,600	185,900 [r]	199,000 [3]
Thailand	27,000	15,300	25,000 [r]	32,900	40,000
Tunisia	41,247	37,900 [e]	35,692	38,000 [r, e]	31,000
Turkey[6]	39,000 [r]	37,000 [r]	43,000 [r]	40,000 [r, e]	39,000
United States	852,000	842,000	780,000	768,000 [r]	739,000 [3]
Vietnam[e]	16,000	16,000	16,000	16,000	16,000
Total	8,770,000	8,910,000	8,520,000 [r]	9,600,000 [r]	9,600,000

[e]Estimated. [p]Preliminary. [r]Revised. -- Zero.

[1]World totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]Table includes data available through July 1, 2005.

[3]Reported figure.

[4]Data are for fiscal year ending March 31 of the following year.

[5]Anglo American plc's Skorpion solvent extraction-electrowinning plant started production in 2003.

[6]Content in ore hoisted.

TABLE 18

ZINC: WORLD SMELTER PRODUCTION, BY COUNTRY[1, 2]

(Metric tons)

Country[3]	2000	2001	2002	2003	2004[e]
Algeria, primary and secondary[e]	34,000	34,000	26,136 [4]	32,200	25,000
Argentina:					
Primary	36,359	39,727	38,699	36,500 [r]	31,500
Secondary	2,910	3,180	3,098	2,500 [r]	2,500
Total	39,269	42,907	41,797	39,000 [r]	34,000
Australia:					
Primary[5]	490,000	554,000	567,000	553,000	473,000 [4]
Secondary[e]	4,500	4,500	4,500	4,500	4,500
Total	494,500	558,500	571,500	557,500 [r]	477,500 [4]
Belgium, primary and secondary	251,700	259,300	260,000 [e]	244,000 [e]	263,000
Brazil:					
Primary	191,777	193,061	249,434	251,000 [r]	259,000
Secondary[e]	7,000	7,000	7,000	7,000	7,000
Total	198,777	200,061	256,434	258,000 [r]	266,000
Bulgaria, primary and secondary	84,200	88,600	83,000	86,800 [r]	87,000
Canada, primary	779,892 [r]	661,172	793,475	761,199 [r]	805,077 [4]
China, primary and secondary[e]	1,980,000	2,040,000	2,100,000	2,320,000 [r]	2,500,000
Czech Republic, secondary[e]	150 [r]	250 [r]	200 [r]	250 [r]	250
Finland, primary	222,881	247,179	235,300	265,900	235,000 [4]
France, primary and secondary[e]	350,000 [4]	347,000	350,000	253,000	260,000
Germany, primary and secondary	327,500 [r]	358,300	378,560 [r]	388,112 [r]	364,000
India:					
Primary	176,000	207,000 [e]	231,400	253,900	238,400 [4]
Secondary[e]	25,000	25,000	24,000	24,000	24,000
Total	201,000	232,000	255,400	277,900	262,400 [4]
Iran[e]	49,000 [4]	73,000	82,000 [r]	84,000 [r]	105,000
Italy, primary and secondary	170,300	177,800	176,000	123,000 [e]	130,000
Japan:					
Primary	541,704	541,277	547,183	532,704	534,830 [4]
Secondary	157,047	142,777	126,723	153,411	132,417 [4]
Total	698,751	684,054	673,906	686,115	667,247 [4]
Kazakhstan, primary and secondary	262,200	277,100	286,300	279,000 [r]	316,500 [4]
Korea, North, primary and secondary[e]	60,000 [r]	60,000 [r]	60,000 [r]	60,000 [r]	60,000
Korea, Republic of, primary	473,897	508,000	600,027	647,500 [r]	671,000
Macedonia, primary and secondary[e]	69,800	52,000 [r]	56,000 [r]	28,000 [r]	--
Mexico, primary	235,073	303,810	302,122	320,364 [r]	320,000
Namibia[6]	--	--	35	47,436	119,200 [4]
Netherlands, primary[7]	216,800	204,800	203,000 [e]	223,000	225,000
Norway, primary	125,800	145,000 [r]	145,000 [r]	142,000 [r]	140,000 [4]
Peru, primary	199,813	204,646 [r]	172,688	202,076 [r]	195,692 [4]
Poland, primary and secondary	173,000 [e]	174,700	158,900	153,300 [r]	153,000
Portugal[e]					
Primary	-- [r]	-- [r]	-- [r]	-- [r]	--
Secondary	3,600	3,600	3,600	3,500	1,500
Total	3,600	3,600	3,600	3,500	1,500
Romania, primary and secondary	51,900	47,200	51,600 [r]	52,000 [r]	50,000
Russia, primary and secondary[e]	230,000	237,000	244,000	253,000 [r]	240,000
Serbia and Montenegro, primary and secondary	8,291	13,467	1,478	62 [r]	100
Slovakia, secondary[e]	1,000	1,000	1,000	1,000	1,000
South Africa, primary	103,000	109,000	105,000 [e]	115,000	104,000
Spain, primary and secondary	386,300	418,000	488,000	519,000 [r]	525,000 [4]
Thailand, primary	77,525	74,129	105,000 [r]	107,000 [r]	103,000
United Kingdom, primary and secondary[e]	76,000 [4]	90,000	98,000	14	--

See footnotes at end of table.

TABLE 18—Continued
ZINC: WORLD SMELTER PRODUCTION, BY COUNTRY[1, 2]

(Metric tons)

Country[3]	2000	2001	2002	2003	2004[e]
United States:					
Primary	228,000	203,000	182,000	187,000	189,000 [4]
Secondary	143,000	108,000	113,000	116,000	117,000 [4]
Total	371,000	311,000	294,000	303,000	305,000 [4]
Uzbekistan, primary[e]	18,000	35,000	30,000	30,000	30,000
Grand total	9,020,000 [r]	9,270,000 [r]	9,690,000 [r]	9,860,000 [r]	10,000,000
Of which:					
Primary	4,120,000	4,230,000 [r]	4,510,000 [r]	4,630,000 [r]	4,550,000
Secondary	344,000 [r]	295,000 [r]	283,000 [r]	312,000 [r]	290,000
Undifferentiated	4,560,000 [r]	4,750,000 [r]	4,900,000	4,920,000 [r]	5,200,000

[e]Estimated. [p]Preliminary. [r]Revised. -- Zero.

[1]World totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]Wherever possible, detailed information on raw material source of output (primary--directly from ores, and secondary—from scrap) has been provided. In cases where raw material source is unreported and insufficient data are available to estimate the distribution of the total, that total has been left undifferentiated (primary and secondary). To the extent possible, this table reflects metal production at the first measurable stage of metal output. Table includes data available through July 1, 2005.

[3]In addition to the countries listed, Israel also produces small amounts of secondary zinc, but available information is inadequate to make reliable estimates of output levels.

[4]Reported figure.

[5]Excludes zinc dust.

[6]Special high-grade electrowon cathodes from Anglo American plc's Skorpian solvent extraction-electrowinning plant.

[7]Sales.